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JAMES DWIGHT DANA.

The Life of James Dwight Dana, Scientific Explorer, Mineralogist, Geologist, Zoologist, Professor in Yale University. By Daniel C. Gilman, President of the John Hopkins University. With illustrations. Pp. 409. (New York and London: Harper and Brothers, 1899.)

SHORTLY after the death of Dana in 1895, a very admirable sketch of the scientific career of his father, from the pen of Prof. E. Salisbury Dana, appeared in the pages of the *American Journal of Science*; but the numerous friends and admirers of the distinguished man—who for many years was justly regarded as the foremost representative of science in the United States—will welcome the fuller memoir now given to the world by his old pupil and friend, President Gilman.

There appears to be some difference of opinion as to whether the members of the Dana family were descended from an Italian or a French stock, but there is little doubt that there were Danas settled in England early in the seventeenth century, and that the ancestor of the American branch was one Richard Dana, who about 1640 emigrated to Cambridge, Massachusetts. Many bearers of the name have attained distinction as divines, lawyers, or literary men; but the father of the great naturalist was engaged in business in the little town of Utica, New York, and it was only the strong bent towards the study of science, which young James Dwight Dana so early betrayed, that led to his abandonment of commercial pursuits, and his devotion to those studies in which he afterwards attained so much distinction.

In the education of Dana we have a striking illustration of the great results that may follow from the efforts of a teacher possessed of enthusiasm and originality—even when he himself may not be distinguished as a scientific discoverer. Dana's capacity for scientific work would seem to have been detected and encouraged by a Mr. Fay Egerton, a teacher in the Utica High School. We are told that

"Mr. Egerton gave lectures in a moderately-furnished laboratory" (this was in the year 1827, in a little backwoods settlement of only five or six thousand inhabitants!) "successively in chemistry, botany, mineralogy and geology, to classes of the older students, who in turn were required, after a study of the topic, to give back the lecture with its experiments to the teacher and their fellows of the class. He was an enthusiast in his own line of study and instruction. Besides his lectures in the lecture-room, he scoured the country round either with or without his pupils, showing them where to go in pursuit of whatever was instructive or curious, assisted them in the naming and care of their specimens, and inspired them with new zeal for natural science. During the long summer vacations he made long excursions with half-a-dozen or more of his class to different parts of the State or to neighbouring ones, visiting localities that abounded in particular rocks or minerals, and bringing home stores for their own or the school collection. These excursions were made almost wholly on foot, a single horse and waggon accompanying the party to carry their scanty wardrobe and relieve the oft-burdened mineral satchel worn by each of them, until such time as they reached a suitable place for shipment."

Every teacher of elementary science in this country may well find encouragement in reading this description of the labours of Fay Egerton. Who can say that among the bright-faced boys watching the experiments or eagerly scanning the specimens shown to them a future Dana may not be present?

It affords a curious comment on the methods of education in this country if we remember that at the very time when Fay Egerton was labouring in a little back settlement of New York to develop the scientific tastes of his pupils, Charles Darwin and his elder brother were being publicly reprimanded in the Shrewsbury Grammar School for wasting their time in setting up a laboratory in which to carry on their experiments!

In 1830, when only seventeen years of age, Dana left Utica and entered Yale College, New Haven, Connecticut, where he came under the influence of Prof. Benjamin Silliman, whose daughter he subsequently married. After taking his degree in 1833, he became an instructor of midshipmen in the U.S. Navy, and sailed in the warship *Delaware* to the Mediterranean, visiting the coasts of France, Italy, Greece and Asia Minor. It was during this voyage that he wrote his first paper, an account of a visit to Vesuvius, which was published in the *American Journal of Science*.

Returning to the United States, a period of suspense, but not of inaction, followed. While seeking for a scientific post, and acting as honorary assistant to Prof. Silliman, he prepared the first edition of his "Treatise on Mineralogy," a work which, being continually improved and enlarged in the five successive editions that have appeared in the last sixty years, will always remain a monument of Dana's great attainments and vast industry.

In 1838 Dana was appointed one of the naturalists to the celebrated exploring expedition under Commodore Wilkes. It is interesting to notice how curiously the careers of Dana and of Asa Gray, the botanist, were influenced by their mutual friendship. Asa Gray succeeded Fay Egerton as teacher of science in the Utica High School, though it does not appear that Dana was ever one of his pupils. When the United States Government determined to send out an exploring expedition, however, Gray accepted the post of naturalist, and it was by his persuasion that Dana was induced to do the same. But at the last moment Gray withdrew, while Dana, as is well known, accompanied the expedition throughout the whole cruise. Gray and Dana were lifelong friends, and among the most interesting letters in the volume before us is the correspondence that passed between them, especially that portion of it relating to the doctrine of evolution.

The United States exploring expedition consisted of five vessels, and between the years 1838 and 1842 it circumnavigated the globe, visiting the islands of the Atlantic and passing through the Straits of Magellan to the west coast of South America; thence through the Paumotu, Tahiti and Samoan groups to Australia, whence a portion of the expedition proceeded south, and discovered land in the Antarctic Ocean. While at Sydney, Dana first heard of the theory which Darwin had shortly before propounded to account for the origin of atolls and barrier-reefs, and during the remainder of the voyage, which led him by way of New Zealand to the Fii Islands, the Sandwich Islands, the Kingsmill

group, and the Carolines, Dana lost no opportunity of testing the theory by application of it to the various islands visited by the expedition. As is well known, Dana, while differing from Darwin on some minor questions, fully accepted the coral-reef theory of the latter author, and remained, to the end of his life, its most staunch and enthusiastic defender. While in Magellan's Straits, the ship to which Dana was attached only very narrowly escaped shipwreck, and, after leaving the Sandwich Islands, the *Peacock*, with Dana on board, was totally lost near the mouth of the Columbia River. After this unfortunate experience, in which Dana lost all his personal effects and many of his collections, he joined a party which crossed the mountains near Mount Shasta, and made their way down the Sacramento River to San Francisco. At San Francisco Dana joined the *Vincennes*, and returned to New York by way of the Sandwich Islands, Singapore, the Cape of Good Hope, and St. Helena.

The next twelve years of Dana's life were occupied in working out the results obtained during the expedition. In 1849 appeared a great quarto volume, with an atlas, on the geology of the expedition, this having been the part of the work which was especially under his charge. But in 1846 he had already issued a large volume, with folio atlas, a "Report on the Zoophytes," dealing with the corals collected by the expedition; and in 1853 two other large volumes, with another folio atlas, his "Report on the Crustacea," made their appearance. How unremitting were his labours in connection with these three reports will be manifest to all who have to consult these volumes, especially if it be remembered that a large part of the drawings in the plates are by Dana's own hands.

In this combination of geological and zoological work, by one who had so many opportunities for original observation during a long voyage of circumnavigation, we cannot fail to be struck by the parallelism between the careers of Darwin and Dana. Unfortunately, we have to add that, while both attained a great age, they were alike, during the later years of their lives, sufferers from ill-health—the result of the hardships they underwent in their long and arduous journeys in the cause of science. Dana and Darwin never met one another, but during many years they maintained a friendly correspondence, some of the letters that passed between them being printed in the volume before us.

In 1850 Dana was appointed Professor of Natural History in Yale College, but in 1864 his duties were restricted and he became Professor of Geology and Mineralogy. There are many interesting pieces of evidence in the work before us of the able and conscientious manner in which he discharged the duties connected with his chair, and of the esteem and love with which he was regarded by his students and colleagues. In addition to his "System of Mineralogy," he wrote a "Manual of Mineralogy and Lithology," and also a "Treatise on Geology," which is widely known and has passed through four editions, and a little work for beginners, entitled "The Geological Story briefly Told."

Another sphere of activity in which Dana was constantly employed was the editing of the *American Journal of Science*, which had been started by his father-

in-law, the elder Silliman, in 1818, and has long occupied the foremost place among the scientific journals of the United States. Dana became joint editor of the journal with the elder and younger Silliman in 1846, and during the later years of his life was chief editor of the work—a task which has since devolved upon his son, Prof. Edward Salisbury Dana. *Silliman's Journal* has now existed for eighty-two years, and is widely known for its scientific articles, not only in the United States, but in every part of the British Islands and the Continent of Europe, where science is cultivated. Besides many of Dana's most important original contributions to science, the numbers of the *American Journal of Science* contain a long series of notes and reviews from the pen of its ever active editor.

In spite of ill-health, Dana maintained his scientific activity to the end. During his "Wanderjahr," his attention had been specially directed to the formation of coral-reefs, and in addition to his great monograph upon corals, he wrote a popular book, "Corals and Coral Islands," which passed through two editions. In the controversies on the rival theories of the formation of coral-reefs, Dana contributed a masterly summary and review of the whole question. Another subject which had interested him during his first voyage to the Mediterranean, and later in his visit to the Sandwich Islands, was that of Vulcanology. Since his visit to Hawaii, in 1842, so many changes had taken place in the volcanoes of the island, that in 1887, although he had reached the age of seventy-four, he determined to revisit them for the purpose of settling various doubts and difficulties which had arisen in his mind. His well-known work on "Volcanoes" was the outcome of this expedition.

We have spoken of the remarkable parallelism between the careers of Darwin and Dana. The reader of the interesting volume before us will not fail to notice another resemblance between the English and the American naturalists, namely, their singular simplicity and amiability of character. This is evidenced in the case of Dana by innumerable incidents and many expressions contained in letters in the work before us, which show that by all with whom Dana came in contact he was deeply loved. Dana's long and active life had a very quiet and peaceful ending early in 1895. The memoir is written by one who is evidently full of sympathy and admiration for the man, and he is to be congratulated upon having furnished a vivid portrayal of the characteristics of a naturalist whose memory men of science, all over the world, will not willingly let die.

JOHN W. JUDD.

BILLIARDS MATHEMATICALLY TREATED.

Billiards Mathematically Treated. By G. W. Hemming, Q.C. Pp. 45. (London: Macmillan and Co., Ltd., 1899.)

THIS treatise will be useful to the amateur billiard player who has a competent knowledge of mathematics, though not, perhaps, to the very accomplished player who may have attained to excellence by natural gifts of eye and hand, and by long practice without theory. Mr. Hemming had better state in his own words his views upon this question.